

2008 1st Verification Report for Contract Group G – PG&E Fabrication, Process and Manufacturing

Submitted to:

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June 15, 2008

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Executive Summary

This document provides the draft verification report for Pacific Gas and Electric's (PG&E) Fabrication, Process and Manufacturing Contract Group. This contract group was identified as one of five contract groups required to develop a verification report.

The purpose of these Verification Reports is to validate energy efficiency measures and savings claims reported by the utilities, to determine payment of earnings to Investor Owned Utilities (IOUs). This Verification report for PG&E's Fabrication, Process and Manufacturing Contract Group was prepared pursuant to guidance provided by CPUC ED staff.

This Verification report addresses the purpose, objectives and approach for verifying PG&E's Fabrication, Process and Heavy Industrial Manufacturing Program (PGE2004). The report discusses the sampling plan and verification procedures. The results are presented for both site specific verification rates and program-level verification rates.

For verification sampling, the approach was to first construct a rough sample plan for the overall evaluation and then to allocate the 2006-2007 sample proportional to the impacts installed through Q2 2007 as compared with the programs' 2006-2008 goals. Consistent with the Evaluation Framework Study's recommendations, the verification sample was stratified by size of savings, using five strata. The 2006-2007 verification sample is composed of 30 electricity projects and 12 gas projects. A Q4, 2007 database extract was obtained after initiating (reviewing paperwork and/or making contact with the site) or completing 38 out of the 42 sample points. Program activity had nearly doubled with respect to electric energy savings and nearly tripled with respect to gas energy savings as compared to the end of Q2, 2007. To capture program activity from 2007 Q3-Q4 in this First Verification Report, electric and gas projects were re-stratified using the Q4, 2007 database extract. Details of this sample re-design can be found in Section 3.2.2 of this report.

1.1 Site-Specific Verification Rates

Below we present the verification results for the PGE2004 Program, for projects installed through December 2007. Site-specific verification rates by major end-use are presented.

Also included are the results across all sites along with the overall verification rates for the program.

1.1.1 Process Other End-use

Sixteen projects classified by the tracking system extracts under the Process Other end-use were verified in the sample. Ex-ante savings from the tracking system for this end-use were 316,817,932 kWh, 3,831 kW, and 0 therms. Ex-ante savings from the tracking system and associated verification rates are shown in Table 1-1 for the Process Other end-use sample. The verification rate for the kWh energy savings ranges from 0.79 to 1.00 with an average of 0.98.

Table 1-1: Summary of Ex-Ante Savings and Verification Rates for the Process Other End-use

Site	Tracking Database Ex Ante Savings			Verification Rate		
	kW	kWh	Therms	kW	kWh	Therms
B001	394	3,902,824	-	1.00	1.00	-
B002	370	3,819,518	-	1.00	1.00	-
B003	333	3,327,156	-	1.00	1.00	-
B004	248	2,369,046	-	1.00	1.00	-
B005	201	2,211,749	-	1.00	1.00	-
B007	203	2,101,575	-	1.00	1.00	-
B008	212	2,003,552	-	1.00	1.00	-
B009	182	1,921,175	-	1.00	1.00	-
B010	173	1,741,438	-	1.00	1.00	-
B011	154	1,618,033	-	0.92	0.92	-
B014	85	620,707	-	1.00	1.00	-
B016	134	1,340,656	-	0.79	0.79	-
B017	73	630,747	-	1.00	1.00	-
B021	68	251,328	-	1.00	1.00	-
B023a	145	1,502,391	-	1.00	1.00	-
B024a	857	7,456,038	-	1.00	1.00	-
Total	3,831	36,817,932	-			
Average	239	2,301,121	-	0.98	0.98	-

A dash "-" indicates that no savings was claimed

1.1.2 Process (Customized) End-use

Twelve projects classified in the tracking system under the Process (Customized) end-use were verified in the sample. Ex-ante savings from the tracking system for this end-use were 8,160,580 kWh, 932 kW, and 2,055, therms. Energy savings from the program tracking database and associated verification rates are shown in Table 1-2 for the Process (Customized) end-use. The verification rate for the kWh energy savings, kW summer demand savings and therms is 1.0.

Table 1-2: Summary of Ex-Ante Savings and Verification Rates for the Process (Customized) End-use

Site	Tracking Database Ex Ante Savings			Verification Rate		
	kW	kWh	Therms	kW	kWh	Therms
B018	106	928,106	-	1.00	1.00	-
B019	17	152,008	-	1.00	1.00	-
B022	30	248,021	-	1.00	1.00	-
B025	2	17,580	-	1.00	1.00	-
B027	2	17,580	-	1.00	1.00	-
B028	8	65,925	-	1.00	1.00	-
B029	8	65,925	-	1.00	1.00	-
B030	6	52,740	-	1.00	1.00	-
B026a	754	6,612,695	-	1.00	1.00	-
B031	-	-	1,264,741	-	-	1.0
B035	-	-	530,950	-	-	1.0
B038	-	-	260,000	-	-	1.0
Total	932	8,160,580	2,055,691			
Average	78	680,048	685,230	1.00	1.00	1.0

A dash "-" indicates that no savings was claimed

1.1.3 Other End-uses

Fourteen projects classified under Other end-use were verified in the sample. This group of measures is made up of electric measures (lighting, air compressor and "Process Add/Change"), as well as gas projects (process and non-process boilers.) The tracking system energy savings for these measures was 7,587,310 kWh, 732 kW and 12,262,899 therms. Energy savings from the tracking database and associated verification rates are shown in Table 1-3 for the Other end-uses in the verification sample. The verification rate for kWh energy savings ranges from 0.88 to 1.00.

Table 1-3: Summary of Ex-Ante Verification Rates for Other End-uses

Site	Tracking Database Ex Ante Savings			Verification Rate		
	kW	kWh	Therms	kW	kWh	Therms
B006	202	2,131,152	-	1.00	1.00	-
B013	-	923,551	-	1.00	1.00	-
B015	116	557,213	-	1.00	1.00	-
B036a	384	3,741,621	-	0.88	0.88	-
B020	30	233,773	-	1.00	1.00	-
B041a	-	-	4,919,708	-	-	1.0
B032	-	-	1,059,000	-	-	1.0
B043	-	-	4,063,495	-	-	1.0
B033	-	-	754,518	-	-	1.0
B042a	-	-	33,489	-	-	1.0
B034	-	-	624,204	-	-	1.0
B037	-	-	477,292	-	-	1.0
B040	-	-	198,494	-	-	1.0
B039	-	-	132,699	-	-	1.0
Total	732	7,587,310	12,262,899			
Average	52	541,951	1,362,544	0.98	0.98	1.0

A dash "-" indicates that no savings was claimed

1.2 Program-level Verification Rate

To produce the program-level verification rate, the individual verification rates for each of the field sample points were weighted by the size of the kWh or therm impacts associated

with each sample project, and by the proportion of the total program impacts represented by each stratum. Table 1-4 presents the population and sample data used to develop the final weighted results.

Table 1-4: PGE2004 Energy Savings by Size Strata, and Related Final Verification Sample as of Q4, 2007

Electric sample

Strata	PGE2004 Program		Verification Sample		Verification Sample Percent	
	N measures	kWh	N measures	kWh	N measures	kWh
1	4	13,418,544	4	13,418,544	100%	100%
2	7	13,728,673	7	13,728,673	100%	100%
3	19	14,478,387	7	6,503,371	37%	45%
4	55	13,772,779	4	885,130	7%	6%
5	295	14,053,717	5	219,750	2%	2%
6	240	73,587,918	3	17,810,354	1%	24%
Total	620	143,040,018	30	52,565,823	5%	37%

Gas sample

Strata	PGE2004 Program		Verification Sample		Verification Sample Percent	
	N measures	Therms	N measures	Therms	N measures	Therms
1	1	1,264,741	1	1,264,741	100%	100%
2	1	1,059,000	1	1,059,000	100%	100%
3	2	1,378,722	2	1,378,722	100%	100%
4	3	1,515,022	2	1,008,242	67%	67%
5	21	1,533,766	4	624,682	19%	41%
6	14	10,394,567	2	8,983,203	14%	86%
Total	42	17,145,818	12	14,318,590	29%	84%

The verification rates by stratum, as well as the program-level verification rate and the associated confidence interval are shown in Table 1-5. The overall weighted verification rate for kWh is 0.98, with a relative precision of 4 percent at the 90 percent confidence level. The overall verification rate for kW is 0.98, with a relative precision of 4 percent at the 90 percent confidence level.

It was verified that all gas projects were installed as indicated in the tracking database, so the overall verification rate for Therms is 1.00. The variance of the gas sample is zero, so a relative precision and confidence level could not be estimated.

Table 1-5: Program-level Verification Rates for PGE2004

Sampling Strata	Verification Rate		
	kWh	kW	Therm
1	1.00	1.00	1.00
2	0.99	0.99	
3	0.96	0.96	1.00
4	1.00	1.00	1.00
5	1.00	1.00	1.00
6	0.98	0.98	1.00
Weighted VR	0.98	0.98	1.00
90 Percent CI	0.94 to 1.02	0.95 to 1.02	-
Relative Precision	4%	4%	-
N	30	29	12

2

Purpose and Approach

2.1 Background

The PG&E Fabrication, Process and Manufacturing contract group is identified as one of five contract groups required to develop a verification report. The PG&E Fabrication, Process and Manufacturing contract group had roughly 4% of the reported kWh savings compared to PG&E's Residential Retrofit and Small Commercial contract groups which accounted for 43% and 38% of kWh savings, respectively. In terms of gas savings, the PG&E Process and Manufacturing contract group was more significant, accounting for 35% of reported impacts through Q2 2007.

The CPUC ED directed Evaluation Contractors to develop the 1st Verification Report Plan and the 3-year Program Evaluation Plan during the same time-frame. These reports were submitted and approved by the CPUC in February 2008.

2.2 Programs included in PG&E Fabrication, Process and Manufacturing Contract Group

The PG&E Fabrication, Process and Manufacturing Contact Group consists of one comprehensive program (Fabrication, Process and Heavy Industrial Manufacturing Program) that is administered by PG&E and nine third-party programs that are administered by various entities. The program budgets and savings goals (kWh and therms) can be found below.

Program ID	Program Name	Program Budget	kWh Goals (Net)	kWh Installed through 2007	Therm Goals (Net)	Therms Installed through 2007
PGE2004	Fabrication, Process and Manufacturing	48,189,482	164,935,530	114,142,462	12,310,200	12,694,725
PGE2042	Heavy Industry Energy Efficiency	17,850,000	15,400,000	1,161,922	1,613,333	300,970
PGE2046	CA Wastewater Process Optimization	1,848,945	3,600,000	0	141,000	0
PGE2058	Energy Efficiency for Oil Production	16,800,000	104,346,317	25,145,463	0	0
PGE2062	Wastewater Plant Efficiency Improvement Initiative	2,215,500	9,114,300	0	0	0
PGE2064	Refinery Energy Efficiency Program	6,216,000	23,760,000	1,072,487	0	0
PGE2081	AIM (Assessment, Implementation and Monitoring)	5,250,000	28,044,000	0	0	0
PGE2082	VeSM Advantage Plus™	2,140,950	4,469,513	0	417,155	0
PGE2084	ECO Air	5,403,720	14,710,480	924,062	0	0
PGE2087	Commercial / Industrial Boiler Efficiency Program	6,481,369	1,162,000	28,428	1,948,000	312,905
	Total	112,395,966	369,542,140	142,474,824	16,429,688	13,308,600

Verification was conducted for PG&E's Fabrication, Process and Heavy Industry Manufacturing Program (PGE2004), as this program is the largest component of the PG&E Fabrication, Process and Manufacturing contract group accounting for approximately one half of the energy savings goals. As indicated in the table above, the accomplishments for PGE2004 through Q4 2007 were 114,142,462 kWh or 69% of the goal. Projects installed through December 2007 have exceeded the therm goals established for the program. Four of the nine Third-Party Programs did not have any installed projects by the end of 2007; however the remaining 5 programs had installed projects with energy savings of 28,332,362 kWh (14% of goal) and 613,875 therms (15% of goal).

PGE2004 was selected for Verification because of the activity with the program relative to that of the Third Party Programs. For the 2008 Verification, it is expected that the activity in the Third-Party Programs will have increased, and that sample will be drawn from those programs in the contract group for examination in the 2008 Verification report.

To conduct verification in a cost-effective manner and still produce robust results, the CPUC ED focused the 1st Verification Reports on verifying high impact measures that account for a significant share of utility energy and demand savings. Because for the PG&E Fabrication, Process and Manufacturing contract group the 2006-2007 verification activities are essentially nested within the 2006-2008 impact evaluation, a sample plan for the overall evaluation was developed first and then a 2006-2007 verification sample was developed to be proportional to the impacts installed through Q2 2007 as compared with the programs' 2006-2008 goals. This approach was discussed with, and approved by the CPUC ED.

This program is implemented by PG&E and has many features in common with the 2004/05 Standard Performance Contracting and 2004/05 Savings by Design programs, including incentive levels, funds for audits and technical studies, and the availability of energy analysis tools. The program targets energy-intensive industries in the following market segments:

- Industrial manufacturing (includes industrial, fabrication and process)
- Oil and gas extraction and refining
- Water supply, water treatment and wastewater treatment

2.3 Purpose

The purpose of this Verification Report, along with those being submitted by the other contract groups, is to validate energy efficiency measures and savings claims reported by the utilities to determine payment of earnings to Investor Owned Utilities (IOUs)

This verification report for PG&E's Fabrication, Process and Manufacturing Contract Group was prepared pursuant to guidance provided by the CPUC ED staff.

2.4 Summary of Approach

This section describes the approach used to verifying the installation of efficiency measure(s) at sampled sites, along with the analyses to be used 1) within each site to derive a resulting verification ratio and 2) to extrapolate site-based results to the contract group/IOU population. The ultimate objective is to provide quantitative results to the CPUC ED concerning installation accomplishments by IOU/program/measure.

Field verification includes counting installed measures, installed capacity of measures, counting a statistically valid sample of installed measures within a project for larger sites, confirming the efficiency of installed measures, confirming, where needed, the appropriate use of ex-ante impact estimates for DEER (or equivalent) deemed savings measures (not necessary in this first round of verification, as the measures selected for verification are customized in nature), verifying correct operation of installed systems and verifying key evaluation parameters such as hours of operation or control strategies. The details of the field data collection procedures are discussed in Section 3.3 of this report. Individual site summary forms were prepared that detail the findings and results from each sampled site, including a discussion of the reasons for any adjustments to ex-ante claims.

Once individual site verification efforts were completed, verification ratios were estimated for the contract group/IOU population using sample-based site results and the program tracking systems. The resulting verification ratio estimates for the program population are presented at the IOU/program/measure group level. These ratios represent ex-post to ex-ante “differences” in program impacts as a function of installation verification. The extrapolation approach applied to derive population estimates is described in Section 3.1.

3

Verification Sampling and Methodology

In this chapter we present a summary of the sampling plan along with an overview of the approach used to conduct site-specific verifications.

3.1 Sampling Methods

The sample design utilizes the ratio-estimation approach described in Chapter 13 of the *Evaluation Framework Study* and is referenced in the *California Energy Efficiency Evaluation Protocols*.¹ This approach was used to develop program realization rates for the 2002 and 2003 Statewide SPC program evaluations and is being used in the 2004-2005 Statewide SPC evaluation.

A key input to the ratio-estimation sample planning methodology is the error ratio (*er*) that is expected to result, given the evaluation sample size selected. As with the a priori use of the expected coefficient of variation in other sampling methods, the variance in the parameter of interest is not known prior to completing the evaluation work. Instead, analysts must estimate the *er* from other related studies and work or summarize expected sampling results across a range of possible *er* (as is often done with confidence levels).

To more formally investigate the expected precision levels for the 2006-2008 PG&E Fabrication, Process, and Manufacturing impact evaluation, the precision level achieved for a relevant past evaluation was first reviewed -- for the combined 2002-2003 SPC impact evaluation sample the precision estimation process was carried out, as described for ratio estimation-based samples in Chapter 13 of the *Evaluation Framework Study*. Specifically, the error ratio was calculated and the precision expected was estimated, with alternative

¹ Chapter 13 – Sampling, page 358, of the TecMarket Works, 2004. *2002 Evaluation Framework Study*, prepared by TecMarket Works for Southern California Edison Company, June.
http://www.calmac.org/publications/California_Evaluation_Framework_June_2004.pdf

sample sizes as described on pages 358 and 365, respectively, using the results from the 2002-2003 SPC ratio estimation process.²

Using the 2002-2003 SPC sample data, we calculated an error ratio (*er*) of 0.35 using the following formula:

$$\hat{er} = \frac{\sqrt{\left(\sum_{i=1}^n w_i e_i^2 / x_i^\gamma\right) \left(\sum_{i=1}^n w_i x_i^\gamma\right)}}{\sum_{i=1}^n w_i y_i}$$

where

$$\gamma = 0.8$$

$$e_i = y_i - \hat{B} x_i$$

w_i is the case weight,

x is the tracking estimate of savings for each project, and

y is an estimate of the estimated savings from the ex post evaluation.

Again using the 2002-2003 SPC sample, we used the case weights to calculate the stratified ratio estimator of B , denoted \hat{B} , as follows:

$$\hat{B} = \frac{\hat{Y}}{\hat{X}} = \frac{\sum_{i=1}^n w_i y_i}{\sum_{i=1}^n w_i x_i}$$

We then estimated relative precision of \hat{B} , at the 95 and 90 percent confidence levels, for alternative sample sizes using the equation below (which includes finite population correction):

$$rp = 1.96 \sqrt{1 - \frac{n}{N}} \frac{er}{\sqrt{n}} \quad 95\% \text{ CL}$$

$$rp = 1.645 \sqrt{1 - \frac{n}{N}} \frac{er}{\sqrt{n}} \quad 90\% \text{ CL}$$

² See Chapter 7 of Quantum Consulting, 2005. *2003 Statewide Nonresidential Standard Performance Contract (SPC) Program Measurement and Evaluation Study*, prepared by Quantum Consulting, Inc. for Southern California Edison Company, SCE Study ID: SCE0206.01, December.

The resulting precision levels for alternative samples are shown in Figure 3-1 and Figure 3-2 below for the calculated er of 0.35 as well as a range of error ratios that might occur and a large and small program population. It is possible that error ratios will be somewhat higher for the 2006-2008 impact evaluation than they were for the 2002-2003 SPC because the scope of the 2002-2003 M&V effort was much smaller than the expected M&V scope of the 2006-2008 evaluation. The more limited 2002-2003 scope may have resulted in a higher fraction of cases in which evaluation engineers defaulted the realization rate to 1.0 because they were not able to conduct a more rigorous analysis than was conducted as part of the program's savings estimation process. Conversely, the error ratio expected for the verification sample and analysis may be lower than 0.35, since verification rates are usually high and variation low for programs with mandatory verification included in the implementation process (as is the case with some of the programs in this contract group).

Figure 3-1: Expected Relative Sampling Precision (at 95% Confidence Level) Verses Sample Size with Stratified Ratio Estimation for Varying Error Ratios and Large Population (N=5,000)

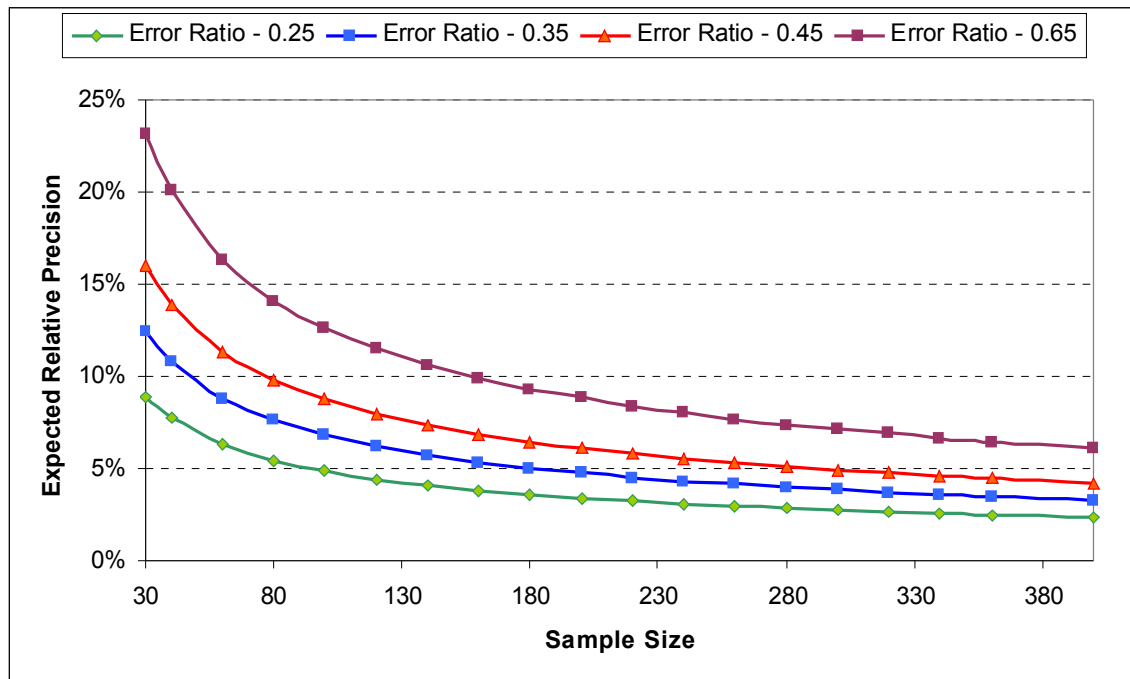
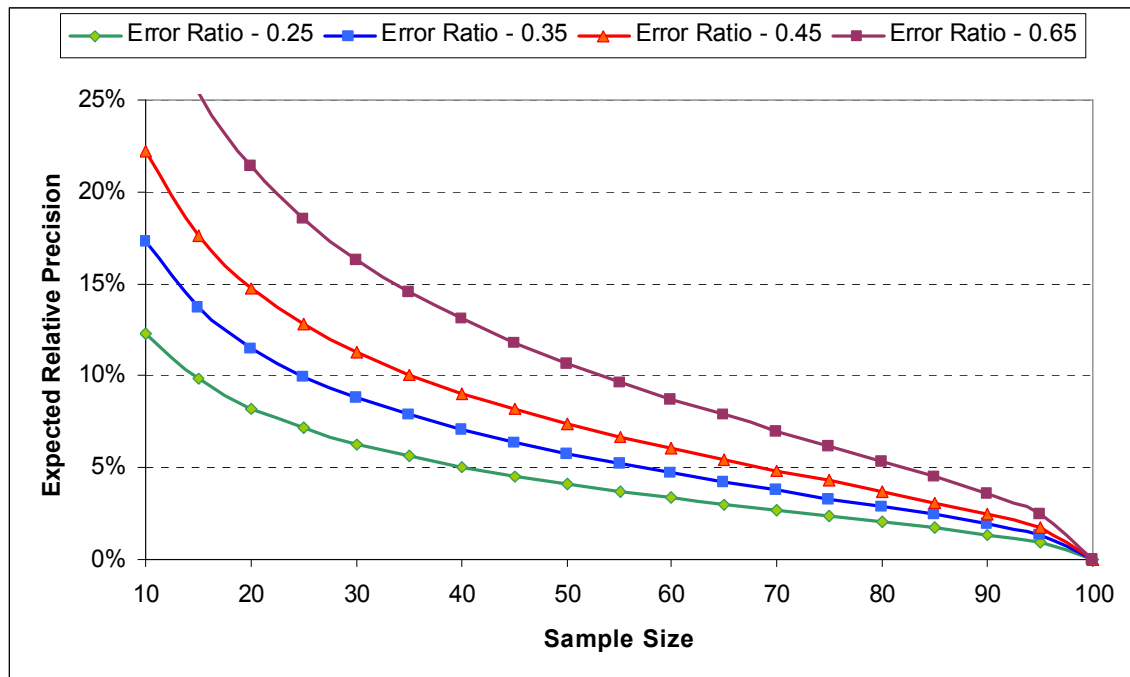


Figure 3-2: Expected Relative Sampling Precision (at 90% Confidence Level) Versus Sample Size with Stratified Ratio Estimation for Varying Error Ratios and Small Population (N=100)



The results in the figures are generally consistent with the example given in the *Evaluation Framework Study* (p. 366) and shows that precision levels as a function of sample size are highly non-linear.

Perhaps the most important aspect of any sample design for programs that address medium and large nonresidential customers is the use of stratification based on the amount of savings associated with each project. In implementing size stratification, typically projects are grouped into 3 to 5 strata from largest to smallest within which total savings are relatively equal for each stratum. It is not uncommon to find a 100-fold difference in average savings between the stratum with the largest and smallest projects (for example, the difference between strata 1 and 5 for the 2004-2005 SPC Evaluation was 75 fold). The improvement in sampling efficiency that can result from size stratification in the nonresidential sector can often be an order of magnitude decrease in sample sizes that would otherwise be required. In our sample design we included a census of the projects in the largest stratum (the certainty stratum), but also sampled projects in all of the other strata.

3.2 Verification Sample Plan

In this section we present the results of our initial sample planning. Because a significant portion of the evaluation work for this contract group will be conducted utilizing the M&V

protocols and will produce site-specific reports and realization ratios, each site will require extensive engineering resources and time to complete. Consequently, the 2006-2007 verification sample is being nested within the 2006-2008 impact sample so that the engineering team can begin conducting the impact evaluation analysis in conjunction with completing the verification work (as per the CPUC ED Guidelines, the impact results are not reported as part of this 1st Verification Report). Thus, the sampling approach is to first construct a rough sample plan for the overall evaluation and then to allocate the 2006-2007 sample proportional to the impacts installed through Q2 2007 as compared with the programs' 2006-2008 goals.

The proposed sample plan for the overall impact evaluation is summarized and discussed in Section 6.13 of the overall evaluation research plan and can be found in Table 3-1 below. The samples results in roughly 90/10 relative precision for electric verification and for gas verification (due to the small population of gas projects). Taking the overall impact evaluation sample as an initial target, points are then roughly allocated back to the 2006-2007 verification sample such that the fraction of total sample points is roughly equal to the percent of source Btu installed to date as a percent of goal. The 2006-2007 verification sample is shown in Table 3-1. The electric 2006-2007 verification sample is composed of 30 projects and the gas sample is composed of 12 projects.

Table 3-1: PG&E Fabrication, Process, and Manufacturing Estimated Reported Impacts through Q2 2007 and M&V Sample Points and Relative Precision

Utility	ProgramID	Program	NetkWh	NetkW	NetTherms	Estimated Number of Electric Measure Projects	Estimated Number of Gas Measure Projects	~# of Sample Points - Electric	~# of Sample Points - Gas	Estimated Relative Precision - Electric (w. er=0.35)	Estimated Relative Precision - Gas (er=0.35)
PG&E	PGE2004	Fabrication, Process and Heavy Industrial Manufacturing	164,935,530	26,390	12,310,200	330	31	50	20	90/8	90/9

3.2.1 Sample Stratification

Consistent with the Evaluation Framework Study's recommendations, we stratified our verification sample by size of savings, using five strata. Table 3-2 summarizes the population tracking data by strata, as provided in the Q2, 2007 tracking database extracts, as well as the initial sample design. This Table indicates the following:

- For the electric projects, the first two size strata include the largest 11 electric applications, which represent 3% of total electric applications and 39% of electric energy savings.
- For the gas projects, the first four strata include the largest 7 gas applications, which represent 25% of total gas applications and 77% of gas energy savings.

- The proposed electric and gas samples were drawn randomly within each stratum. The electric sample included a census of projects in the first two strata, while the gas sample included a census of projects in the first four strata.

Table 3-2: PGE2004 Energy Savings by Size Strata, and Related Verification Sample Design as of Q2, 2007

Electric sample

Strata	PGE2004 Program		Verification Sample		Verification Sample Percent	
	N measures	kWh	N measures	kWh	N measures	kWh
1	4	13,418,544	4	13,418,544	100%	100%
2	7	13,728,673	7	13,728,673	100%	100%
3	19	14,478,387	7	5,505,550	37%	38%
4	55	13,772,779	6	1,407,347	11%	10%
5	295	14,053,717	6	243,923	2%	2%
Total	380	69,452,101	30	34,304,038	8%	49%

Gas sample

Strata	PGE2004 Program		Verification Sample		Verification Sample Percent	
	N measures	Therms	N measures	Therms	N measures	Therms
1	1	1,264,741	1	1,264,741	100%	100%
2	1	1,059,000	1	1,059,000	100%	100%
3	2	1,378,722	2	1,378,722	100%	100%
4	3	1,515,022	3	1,515,022	100%	100%
5	21	1,533,766	5	687,462	24%	45%
Total	28	6,751,251	12	5,904,947	43%	87%

Projects were sampled randomly within each stratum; each stratum was over-sampled by 50% to obtain an adequate pool of backup applications.

3.2.2 Final Sample Design

A Q4, 2007 database extracts was received after contacting program participants to schedule site visits or completing site visits at 38 out of the 42 sample points. As shown in Table 3-3, program activity at the end of Q4, 2007 nearly doubled with respect with electric energy savings and nearly tripled with respect to gas energy savings as compared to the end of Q2, 2007. To capture program activity from Q3-Q4 in this First Verification Report, electric and gas projects were re-stratified using the Q4, 2007 database extract. The remaining untouched sample points from the original sample design (2 electric and 2 gas projects) were then replaced with 3 new electric and 2 new gas projects that were installed in Q3-Q4. In an effort to capture the largest possible fraction of energy savings in Q3-Q4 the largest projects installed in Q3-Q4 were selected. The redesigned sample is presented in Table 3-3.

Table 3-3: PGE2004 Energy Savings by Size Strata, and Related Final Verification Sample Design as of Q4, 2007

Electric sample

Strata	PGE2004 Program		Verification Sample		Verification Sample Percent	
	N measures	kWh	N measures	kWh	N measures	kWh
1	5	25,532,696	5	25,532,696	100%	100%
2	13	30,780,474	7	16,065,405	54%	52%
3	26	28,696,698	6	8,054,174	23%	28%
4	76	29,409,735	7	3,046,359	9%	10%
5	500	28,620,416	6	371,758	1%	1%
Total	620	143,040,018	31	53,070,393	5%	37%

Gas sample

Strata	PGE2004 Program		Verification Sample		Verification Sample Percent	
	N measures	Therms	N measures	Therms	N measures	Therms
1	1	4,919,708	1	4,919,708	100%	100%
2	1	4,063,495	1	4,063,495	100%	100%
3	1	1,264,741	1	1,264,741	100%	100%
4	4	2,968,672	4	2,968,672	100%	100%
5	35	3,929,202	5	1,125,424	14%	29%
Total	42	17,145,818	12	14,342,040	29%	84%

It was not possible to verify one electric project and one gas project that had been included in the field sample. The gas sample point that could not be completed was re-allocated within the same stratum using backup sample. The electric site that could not be completed was cancelled since the redesigned electric sample had one project more than the plan (31 electric projects in Table 3-3 vs. 30 electric projects in Table 3-2).

During subsequent discussions with the CPUC ED, it was suggested that project stratification be changed to reflect the fact that the vast majority of projects in the sample were drawn from the tracking database dated Q2, 2007. Table 3-4 contains the final sample disposition for the verification sample. A comparison with Table 3-2 and Table 3-3 shows that strata 1-5 include projects completed through the end of Q2, 2007, while the new stratum 6 consists of the projects installed in Q3-Q4, 2007 only. The verification sample captures 37% of electric energy impacts and 84% of gas impacts for the PGE2004 Program through Q4, 2007.

Table 3-4: PGE2004 Energy Savings by Size Strata, and Related Final Verification Sample as of Q4, 2007**Electric sample**

Strata	PGE2004 Program		Verification Sample		Verification Sample Percent	
	N measures	kWh	N measures	kWh	N measures	kWh
1	4	13,418,544	4	13,418,544	100%	100%
2	7	13,728,673	7	13,728,673	100%	100%
3	19	14,478,387	7	6,503,371	37%	45%
4	55	13,772,779	4	885,130	7%	6%
5	295	14,053,717	5	219,750	2%	2%
6	240	73,587,918	3	17,810,354	1%	24%
Total	620	143,040,018	30	52,565,823	5%	37%

Gas sample

Strata	PGE2004 Program		Verification Sample		Verification Sample Percent	
	N measures	Therms	N measures	Therms	N measures	Therms
1	1	1,264,741	1	1,264,741	100%	100%
2	1	1,059,000	1	1,059,000	100%	100%
3	2	1,378,722	2	1,378,722	100%	100%
4	3	1,515,022	2	1,008,242	67%	67%
5	21	1,533,766	4	624,682	19%	41%
6	14	10,394,567	2	8,983,203	14%	86%
Total	42	17,145,818	12	14,318,590	29%	84%

3.3 Verification Procedures

This section describes the field procedures that were followed in verifying the installation of efficiency measures at sampled sites, along with the analyses applied 1) within each site to derive a resulting verification ratio and 2) to extrapolate site-based results to the contract group/IOU population. The ultimate objective of the effort is to provide results to the CPUC ED concerning installation accomplishments by IOU/program/measure.

Field verification includes simple counting of installed measures, counting and quantifying installed capacity of measures, counting a statistically valid sample of installed measures for larger sites, confirming the technology-based efficiency of installed measures, confirming, where needed, the appropriate use of ex-ante impact estimates for DEER (or equivalent) deemed savings measures (not necessary in this first round of verification, as the measures selected for verification are customized in nature), verifying correct operation of installed systems and verifying key evaluation parameters such as hours of operation or control strategies. The details of the field data collection procedures are discussed below in Sections 3.3.1 through 3.3.4.

Following site data collection, field data from each selected verification site was analyzed to derive measure-specific verification ratios for each impact determinant -- peak electric

demand (kW), annual electric energy (kWh) and annual natural gas energy (therms). Based on CPUC ED direction, this 2006-2007 Verification Report contains only the count-related verification ratio. Individual site summary reports were prepared that detail the findings and results from each sampled site, including a discussion of the reasons for any adjustments to ex-ante claims.

Once individual site verification efforts were completed, verification ratios were estimated for the contract group/IOU population using sample-based site results and the program tracking systems. The resulting verification ratio estimates for the program population are presented at the IOU/program/measure group level in Section 4 of this report. These ratios represent ex-post to ex-ante “differences” in program impacts as a function of installation verification. The extrapolation approach that was applied to derive population estimates is described below in Section 3.3.7.

3.3.1 Site Assignment and Documentation

The field verification process began with the assignment of a site to a lead engineer, who, in most cases, will be responsible for the full impact evaluation³. The lead engineer was selected based on his/her capabilities and experience with particular measures, the type of site, and by geographic proximity. All of the sites associated with a particular company or organization were assigned to the same lead engineer and the following documents were organized by site for use by the field and analytical team:

- **Contact Data.** For each site contact information was assembled from the tracking system and/or hard copy/electronic files, including customer contact name, telephone number, e-mail address, business name, mailing address and physical address, as well as program reviewer and vendor contact information.
- **Measure Installation Data.** For each site a full listing of installed measures was prepared, by building/site where warranted⁴, and entered into a form. This measure listing was assembled using a combination of data available from the program tracking system and data available in the program application hard copy/electronic files. Where verification of a census of installed measures was not feasible (due to the extensive nature of retrofit work completed, end-use targeted sampling or other factors), a sample of measures was identified for verification data collection (this is discussed further in Section 3.3.5 below).
- **Application Files.** A copy of all the relevant IOU application files.

³ The sites selected for verification will be a nested sample of sites selected for full impact evaluation.

⁴ Some applications sampled might include equipment installed at multiple sites (for example, upgrades at several oil refinery facilities) and/or equipment installed in multiple buildings within a site.

- **Program Tracking System Data.** These data included ex-ante energy impacts, measure descriptions, contact information including phone numbers and e-mail addresses (site contact, customer contact, sponsor contact, vendor contact and program reviewer contact, if available).
- **Utility Billing and Interval Data.** Data from 2004 to present were obtained.

The lead engineer performed a complete review of the application file and tracking system as there can be changes in the project and discrepancies in the application and tracking system. This review also allowed discovery of the most relevant variables for determination of the efficacy, capacity and other verification measures that are not easily quantified (such as control strategies).

The lead engineer was responsible for maintaining site-level project tracking information from the recruitment effort through completion of site-specific analysis and reporting requirements. This included all customer/IOU/sponsor/vendor contact and the completion of pre-defined verification milestones, including the recruitment phase, scheduling phase, data collection phase, analysis phase and reporting phase.

3.3.2 Site Recruitment

Lead engineers were responsible for recruiting their assigned sites. Prior to recruiting a verification project, the lead engineer performed a review of the application file. When the review was completed, the engineer recruited the site and scheduled/coordinated a verification/evaluation site visit. IOU account representatives were notified prior to recruitment.

A Verification Data Collection form was prepared for each sampled measure. The data on each form included a complete description of the measures installed, which provided a means to compare results against tracking system and/or application records. The forms also included clear delineation of the applicable “unit of measure” for each sampled measure, such as tons of cooling or linear feet of lamps installed.

3.3.3 Scheduling On-Site Data Collection

The following guidelines were followed in scheduling the on-site survey:

- The IOU representative for the site was notified.
- In a first call to the site it was confirmed that someone at the site was familiar with the sampled measure and knew its location. If the site contact did not know or could

not determine the location of the measures, additional site or sponsor contacts were consulted.

- When possible, appointments were made and confirmed by email one week in advance of the site visit with final confirmation the day before the visit.
- The site contact was provided with the name and phone number of the person conducting the site visit.
- IOU representatives were notified that had expressed interest in being present during all or a portion of the on-site survey work.
- The expected duration of the site visit was estimated and communicated to all parties. Most visits were completed in a half day. Where longer visits were involved, field staff attempted to minimize impacts at the site.
- Since the verification sample is a subset of the M&V sample for this project, site contacts were informed of any expected metering work supporting the evaluation work effort.
- Requests for applicable information from the site contact were made (including lighting tables, building/project plans and equipment specifications, EMS schedules, etc.) as it increased the effectiveness of the verification and M&V efforts.
- When possible, sites were grouped geographically to minimize travel time between sites.

3.3.4 On-Site Data Collection

The on-site survey documents the number and type of equipment that was installed and its current operational status. The assigned engineer or field technician entered data surrounding field verified installed measure counts and operational status on the Verification Data Collection form. The comprehensiveness of on-site data collection efforts varied site-to-site depending on the extent of each installation – for example, most sites included verification for a census of installed measures, but some sites required within site or within measure sampling approaches, as discussed in more detail below under Sections 3.3.5. The data collected confirmed the measure description (equipment type, make and model, nameplate information, etc.) and the count of equipment which comprises each measure selected for verification along with the operational status of that equipment. In addition, the location of the equipment and other important information to be used in the analysis phase of the verification effort was recorded for entry into the verification/evaluation database.

The following data were recorded for measures selected for verification:

Measure Description: Measure manufacturer, model, equipment type, capacity, efficiency and other relevant nameplate information was recorded. These data were used to verify application-based assertions surrounding the equipment installed.

Installation Date: While on-site, an effort was made to confirm the installation date noted in the application file by either interviewing the site contact or examining information available on site that could confirm this date.

Location: A brief description of the location of the measure within the facility. The description is specific enough for a third party to easily find the measure.

Portion of Installation Inspected: If the verification effort was for just a portion of the total installed quantity of a particular measure, then a description of the area inspected was included. In such instances, verification of the installed quantity was attempted using extrapolation to the entire facility. In most instances it was necessary to collect additional information that can be leveraged to provide a proxy of installation percentage.

Unit Quantity Installed: The number of “measure units” installed at the facility during the site visit. If installation status information was not directly observed, then a note was made at the bottom of the form.

Unit Quantity Conclusion: The assigned engineer/field technician drew a conclusion regarding the fraction of each installation observed during the installation.

Unit Quantity Operational: The number of units found that are operational. They may not be operating during the site visit but they are confirmed to be capable of operating according to their scheduled control sequence. Numbers were given for this entry; however, in some instances, a qualitative description was necessary. Inquiries from the site contact about the operational status were made if direct observations could not be made. If operational status information was not directly observed then a note was made at the bottom of the form.

Unit Operational Conclusion: The assigned engineer/field technician drew a conclusion regarding the fraction of each quantity observed to be operational. If unable to draw a conclusion then the reason was stated.

Ex Ante Estimate Verification and Review: The assigned engineer/field technician verified if ex ante impact estimates were adequately documented and drew a conclusion whether or not the ex ante approach selected was deemed to be inadequate, adequate or of high quality.

Ex ante calculations were reviewed for appropriate methodologies, refinement of variables, and possible errors. Verifiers noted any issues regarding the accuracy of the estimates that should be investigated in the full evaluation.

The site-level verification efforts accomplish the following objectives:

- Quantify the number of units installed under the program and compare this result to the number of units claimed in the IOU tracking database and the application data.
- Quantify the number of units that are operational under the program and compare this result to the number of units claimed in the IOU tracking database and the application data.
- Collect additional supporting information relevant to the performance of the installed measures, such as installation date, locations of installed units, manufacturer and model number, efficiency rating, hours of run time, control set points, and control strategies. Note any differences from the application paperwork and original measure intent.
- To the extent possible, determine the reasons for discrepancies (if any) between the claimed counts and the verified counts, as well as differences in usage or control strategies that impact energy savings.
- For DEER measures, review the ex-ante savings estimates (kWh and kW). Any issues regarding the accuracy of the estimates that should be investigated further in the full evaluation were noted.
- For customized measures, review the ex ante application-based impact estimates and document all issues or problems identified.

To the extent possible, the site-level verification efforts tried to accomplish the following objectives:

- The collection of additional performance data for use in the subsequent full evaluation analysis, to reduce the number of customer contacts and reduce data collection costs. Upon review of the project application file, it was determined what variables are most relevant and most uncertain, and the evaluation approaches could yield the best results.
- The use of spot measurements and installation of measurement and verification equipment to verify variables and inputs to better quantify energy impacts. This step is particularly important for weather sensitive measures or cyclical operations, in order to procure data over several periods.

3.3.5 Sampling Within Applications and Within Measures

Wherever possible the field verification efforts comprised a census of the measures installed. However, some applications included installations at multiple sites and/or a site might involve a large number of measures or installations across a substantial number of buildings or, in the case of pump-off-controllers, over a wide geographic area. In the case of pump-off-controllers, sites were randomly selected for the well retrofits included in the application using a random number generator. This sampling approach was discussed and received approval from the CPUC ED.

3.3.6 Site Level Verification Analysis

Verification analysis at the site level was completed using field data from each selected verification site at the measure level. The result is an ex post-to-ex ante ratio based on an operational-adjusted measure count ratio (where verification results are supported by measure counts, measure capacity), and an operability assessment. Brief individual site reports were prepared that detail the findings and results from each sampled site, including a discussion of the reasons for accepting or rejecting ex-ante installation claims.

The ratio-based results reflect the “differences” in ex post estimates vs. ex ante tracking system records.

3.3.7 Application of Sample Results to the Program Population

Once individual site verification efforts were completed, verification ratio estimates were made for the contract group/IOU population using sample-based site results and the program tracking systems. Ratio-based results were applied back to the full program population using ratio estimation weights, resulting in verification-adjusted ex ante impact estimates for the IOU at the contract group level, the program or for any given measure in the contract group. To produce the program-level verification rate, the individual verification rates for each of the field sample points were weighted by the size of the kWh or therm impacts associated with each sample project, and by the proportion of the total program impacts represented by each stratum.

The resulting verification ratio estimates for the program population at the IOU/program/measure level are presented in the following section of this report.

4

Verification Analysis and Findings

This chapter presents and discusses the verification analysis and findings for the PGE2004 Program, for projects installed through December 2007. Site-specific verification rates are summarized by major end-use and the results are examined across all sites and the overall verification rates for the program are presented.

4.1 Site-Specific Verification Rates

In this sub-section verification rates are presented on an unweighted basis by program end-use (Process Other, Process Customized, Other Measures). Anonymous site-specific results are included in summary tables. The verification includes a total of 42 sites, of which 30 had electric measures and 12 had gas measures installed. As described in Section 3, a verification plan and a verification report were developed for each site.

4.1.1 Process Other End-use

Sixteen projects classified by the tracking system extracts under the Process Other end-use were verified in the sample. Ex-ante savings from the tracking system for this end-use were 316,817,932 kWh, 3,831 kW, and 0 therms.

Ex-ante savings from the tracking system and associated verification rates are shown in Table 4-1 for the Process Other end-use sample. The verification rate for kWh energy savings ranges from 0.79 to 1.00. The unweighted average realization rate for Process Other energy savings is 0.98. Similarly, the verification rate for summer kW demand ranges from 0.79 to 1.00, with an unweighted average of 0.98.

Table 4-1: Summary of Ex-Ante Savings and Verification Rates for the Process Other End-use

Site	Tracking Database Ex Ante Savings			Verification Rate		
	kW	kWh	Therms	kW	kWh	Therms
B001	394	3,902,824	-	1.00	1.00	-
B002	370	3,819,518	-	1.00	1.00	-
B003	333	3,327,156	-	1.00	1.00	-
B004	248	2,369,046	-	1.00	1.00	-
B005	201	2,211,749	-	1.00	1.00	-
B007	203	2,101,575	-	1.00	1.00	-
B008	212	2,003,552	-	1.00	1.00	-
B009	182	1,921,175	-	1.00	1.00	-
B010	173	1,741,438	-	1.00	1.00	-
B011	154	1,618,033	-	0.92	0.92	-
B014	85	620,707	-	1.00	1.00	-
B016	134	1,340,656	-	0.79	0.79	-
B017	73	630,747	-	1.00	1.00	-
B021	68	251,328	-	1.00	1.00	-
B023a	145	1,502,391	-	1.00	1.00	-
B024a	857	7,456,038	-	1.00	1.00	-
Total	3,831	36,817,932	-			
Average	239	2,301,121	-	0.98	0.98	-

A dash "-" indicates that no savings was claimed

A description of the measure installed at each site is shown in Table 4-2 for the Process Other end-use sample. The most common measure is the pump-off controller for oil well pumps.

Table 4-2: Summary of Measures Installed Process Other End-use

Site ID	Tracking System Description	Measure Description
B001	PROCESS OTHER	Install 174 Pump-Off Controllers (POCs)
B002	PROCESS OTHER	Install 203 Pump-Off Controllers (POCs)
B003	PROCESS OTHER	Install 173 Pump-Off Controllers (POCs)
B004	PROCESS OTHER	Install 125 Pump-Off Controllers (POCs)
B005	PROCESS OTHER	Install 157 Pump-Off Controllers (POCs)
B007	PROCESS OTHER	Install 191 Pump-Off Controllers (POCs)
B008	PROCESS OTHER	Install 132 Pump-Off Controllers (POCs)
B009	PROCESS OTHER	Install 175 Pump-Off Controllers (POCs)
B010	PROCESS OTHER	Install 117 Pump-Off Controllers (POCs)
B011	PROCESS OTHER	Install 174 Pump-Off Controllers (POCs)
B014	PROCESS OTHER	Replace 4 Commercial Washers with 1 Tunnel Washer and 3 Dryers with 2 More Efficient Dryers
B016	PROCESS OTHER	Install 94 Pump-Off Controllers (POCs)
B017	PROCESS OTHER	Install New 500 Ton All-Electric Injection Molding Machine
B021	PROCESS OTHER	Replace Blower / Motor with New Blower / Motor with VFD
B023a	PROCESS OTHER	Install VFD on two (2) Oil Well Motors
B024a	PROCESS OTHER	Install New 600 Ton All-Electric Injection Molding Machine

4.1.2 Process (Customized) End-use

Twelve projects classified in the tracking system under the Process (Customized) end-use were verified in the sample. Ex-ante savings from the tracking system for this end-use were 8,160,580 kWh, 932 kW, and 2,055, therms.

Energy savings from the program tracking database and associated verification rates are shown in Table 4-3 for the Process (Customized) end-use. The verification rate for the kWh energy savings, kW summer demand savings and therms is 1.0.

Table 4-3: Summary of Ex-Ante Savings and Verification Rates for the Process (Customized) End-use

Site	Tracking Database Ex Ante Savings			Verification Rate		
	kW	kWh	Therms	kW	kWh	Therms
B018	106	928,106	-	1.00	1.00	-
B019	17	152,008	-	1.00	1.00	-
B022	30	248,021	-	1.00	1.00	-
B025	2	17,580	-	1.00	1.00	-
B027	2	17,580	-	1.00	1.00	-
B028	8	65,925	-	1.00	1.00	-
B029	8	65,925	-	1.00	1.00	-
B030	6	52,740	-	1.00	1.00	-
B026a	754	6,612,695	-	1.00	1.00	-
B031	-	-	1,264,741	-	-	1.0
B035	-	-	530,950	-	-	1.0
B038	-	-	260,000	-	-	1.0
Total	932	8,160,580	2,055,691			
Average	78	680,048	685,230	1.00	1.00	1.0

A dash "-" indicates that no savings was claimed

A description of the measure installed at each site is shown in Table 4-4 for the Process (Customized) end-use. The most common measure is once again the pump-off controller, although the end-use also includes three gas projects.

Table 4-4: Summary of Measures Installed Process (Customized) End-use

Site ID	Tracking System Description	Measure Description
B018	PROCESS (CUSTOMIZED)	Install 25 Pump-Off Controllers (POCs)
B019	PROCESS (CUSTOMIZED)	Install POCs on 2 Oil Wells; Install Fiber Glass Rod to Reduce Pumping Energy
B022	PROCESS (CUSTOMIZED)	Install Two (2) New All Electric Injection Molding Machines
B025	PROCESS (CUSTOMIZED)	Install POC for New Oil Well
B027	PROCESS (CUSTOMIZED)	Install POC (on 20 HP Motor) for New Oil Well
B028	PROCESS (CUSTOMIZED)	Install POC (on 75 HP Motor) for New Oil Well
B029	PROCESS (CUSTOMIZED)	Install POC for New Oil Well
B030	PROCESS (CUSTOMIZED)	Install POC for New Oil Well
B026a	PROCESS (CUSTOMIZED)	Water Pipe Size Upgrade
B031	PROCESS (CUSTOMIZED)	Increase Waste Heat Recovery in HRSG (Heat Recovery Steam Generator)
B035	PROCESS (CUSTOMIZED)	Increase Waste Heat Recovery in HRSG (Heat Recovery Steam Generator)
B038	PROCESS (CUSTOMIZED)	Install New Urban Wood Processing System Eliminating Need for Pre-dryer

Table 4-2 and Table 4-4 show that in the PGE2004 tracking database the same measure (e.g. pump-off controllers, injection molding machines) is coded as "Process Other, while others are coded as "Process (Customized)". The designation of one end-use or the other seems to be used consistently by the PG&E programs that contribute to the PGE2004 Program: the SPC Program uses "Process Other" whereas Savings By Design uses "Process (Customized)" for these measures.

4.1.3 Other End-uses

Fourteen projects classified under Other End-Use were verified in the sample. This group of measures consists of electric measures (lighting, air compressor and “Process Add/Change”), as well as gas projects (process and non-process boilers.) The tracking system energy savings for these measures is 7,587,310 kWh, 732 kW and 12,262,899 therms.

Energy savings from the tracking database and associated verification rates are shown in Table 4-5 for the Other End-Uses in the verification sample. The verification rate for kWh energy savings ranges from 0.88 to 1.00, with an unweighted average of 0.98. Similarly, the verification rate for the demand kW ranges from 0.88 to 1.00, with an unweighted average of 0.98. The unweighted average realization rate for the therm savings is 1.00.

**Table 4-5: Summary of Ex-Ante Verification Rates
Other End-uses**

Site	Tracking Database Ex Ante Savings			Verification Rate		
	kW	kWh	Therms	kW	kWh	Therms
B006	202	2,131,152	-	1.00	1.00	-
B013	-	923,551	-	1.00	1.00	-
B015	116	557,213	-	1.00	1.00	-
B036a	384	3,741,621	-	0.88	0.88	-
B020	30	233,773	-	1.00	1.00	-
B041a	-	-	4,919,708	-	-	1.0
B032	-	-	1,059,000	-	-	1.0
B043	-	-	4,063,495	-	-	1.0
B033	-	-	754,518	-	-	1.0
B042a	-	-	33,489	-	-	1.0
B034	-	-	624,204	-	-	1.0
B037	-	-	477,292	-	-	1.0
B040	-	-	198,494	-	-	1.0
B039	-	-	132,699	-	-	1.0
Total	732	7,587,310	12,262,899			
Average	52	541,951	1,362,544	0.98	0.98	1.0

A dash "-" indicates that no savings was claimed

A description of the measure installed at each site is shown in Table 4-6 for the Other End-Uses in the verification sample.

Table 4-6: Summary of Measures Installed
Other End-uses

Site ID	Tracking System Description	Measure Description
B006	PROCESS CHANGE/ADD EQUIPMENT	Install Cone Heat Shields for Six Silicone Growth Furnaces
B013	PROCESS CHANGE/ADD EQUIPMENT	Replace Linear Cool Down Unit with Lateral Cool Down Unit (Increased Heat Recovery)
B015	LIGHTING - OTHER	Install More Efficient Lighting Fixtures and Motion Sensors
B036a	LIGHTING - OTHER	Retrofit Metal Halide Lighting with Smaller Fixtures / Bi-level and Tri-level Controls
B020	AIR COMPRESSOR SYSTEM CHANGE/MODIFY	Install Sequencer to Control Air Compressor
B041a	NON-PROCESS BOILER CHANGE/ADD	Gas Water Heating Project
B032	NON-PROCESS BOILER CHANGE/ADD	Install Flue Gas Heat Exchanger at Furnace F-1550
B043	NON-PROCESS BOILER OTHER	Install 200 Feet of High Pressure Steam Line to Reduced Gas Use
B033	PROCESS BOILER HEAT RECOVERY	Replace Main Condensate Receiver / Pulp Dryer Waste Heat Recovery
B042a	PROCESS BOILER HEAT RECOVERY	Replace Linear Cool Down Unit with Lateral Cool Down Unit (Increased Heat Recovery)
B034	PROCESS BOILER BURNERS	Install Automated Damper Control System to Reduce Excess Combustion Air in Furnace
B037	PROCESS BOILER BURNERS	Install High Efficiency Burners
B040	PROCESS BOILER INSULATION	Install Thermal Insulation on Heat Exchanger and Hot Blast Duct to Steel Furnace
B039	PROCESS BOILER OTHER	Replace 4 Commercial Washers with 1 Tunnel Washer and 3 Dryers with 2 More Efficient Dryers

4.2 Program-level Verification Rate

Table 4-7 presents the population and sample data used to develop the final weighted results.

Table 4-7: PGE2004 Energy Savings by Size Strata and Related Final Verification Sample as of Q4, 2007

Electric sample

Strata	PGE2004 Program		Verification Sample		Verification Sample Percent	
	N measures	kWh	N measures	kWh	N measures	kWh
1	4	13,418,544	4	13,418,544	100%	100%
2	7	13,728,673	7	13,728,673	100%	100%
3	19	14,478,387	7	6,503,371	37%	45%
4	55	13,772,779	4	885,130	7%	6%
5	295	14,002,585	5	219,750	2%	2%
6	240	73,035,258	3	17,810,354	1%	24%
Total	620	142,436,226	30	52,565,823	5%	37%

Gas sample

Strata	PGE2004 Program		Verification Sample		Verification Sample Percent	
	N measures	Therms	N measures	Therms	N measures	Therms
1	1	1,264,741	1	1,264,741	100%	100%
2	1	1,059,000	1	1,059,000	100%	100%
3	2	1,378,722	2	1,378,722	100%	100%
4	3	1,515,022	2	1,008,242	67%	67%
5	21	1,530,334	4	624,682	19%	41%
6	14	10,394,580	2	8,983,203	14%	86%
Total	42	17,142,399	12	14,318,590	29%	84%

To produce the program-level verification rate, the individual verification rates for each of the field sample points were weighted by the size of the kWh or therm impacts associated with each sample project, and by the proportion of the total program impacts represented by each stratum, as follows.

- Within each stratum, individual verification rates for the field sample points were weighted using the size of the kWh or Therm impacts for each sample project. This yielded stratum-level verification rates and associated 90 percent confidence intervals for those verification rates.
- The stratum-level verification rates were then weighted using the population kWh or Therm impacts for each stratum, yielding a program-level verification rate and an associated 90% confidence interval.

The verification rates by stratum, as well as the program-level verification rate and the associated confidence interval are shown in Table 4-8. The overall weighted verification rates for kWh and kW are 0.98, with relative precision of 4 percent at 90 percent confidence level for both kWh and kW.

It was verified that all gas projects were installed as indicated in the tracking database, so the overall verification rate for Therms is 1.00. The variance of the gas sample is zero, so a relative precision and confidence level could not be estimated.

Table 4-8: Program-level Verification Rates for PGE2004

Sampling Strata	Verification Rate		
	kWh	kW	Therm
1	1.00	1.00	1.00
2	0.99	0.99	
3	0.96	0.96	1.00
4	1.00	1.00	1.00
5	1.00	1.00	1.00
6	0.98	0.98	1.00
Weighted VR	0.98	0.98	1.00
90 Percent CI	0.94 to 1.02	0.95 to 1.02	-
Relative Precision	4%	4%	-
N	30	29	12